FARADAY FLASHLIGHT

This is a continuation-in-part of co-pending U.S. Patent Application No. 10/392,657 filed March 19, 2003, which is a continuation-in-part of co-pending U.S. Patent Application No. 10/112,848 filed March 29, 2002.

Field of the Invention

The present invention relates to improvements in the technology relating to inexpensive and reliable lighting sources and more particularly to a human powered flashlight free of batteries and free of external integrity breaches and which is engineered to use light efficiently.

Background of the Invention

Production of light with a portable light source or flashlight is a well known expedient in which a tubular body is fitted with a number of series connected batteries. The disadvantages of conventional flashlights with this conventional configuration are generally (1) breach of internal external integrity from having to access the battery compartment fairly regularly to replace batteries, and (2) other breaches of external integrity associated with light bulb changes at the

front of the device and from a mechanical linkage relating to the on and off switch.

In some devices especially built for underwater use, a series of multiple "o" rings may be employed for water sealing. However, when these structures are employed at points likely to be repeatedly accessed, such as the rear entrance to the battery compartment, degradation will likely occur resulting in an eventual breach of sealing integrity.

Other step have been taken to insure integrity such as placing a flexible push button cover over the on and off switch, but these covers tend to either leak early in their functional life at the ring of circular attachment, or later in their functional life by cracking or punching breach. Seals around the bulb changing entrance, typically the front lens cover have proven to be more secure.

Production of energy for lighting using generator devices are also known. In some cases a crank generator is provided with the crank extending through the housing, creating another source of housing fluid breach. Either a scientifically closely toleranced bearing must be provided to keep moisture out (close tolerance along with friction loss) or the generator must itself be water proof. The generator is itself a complex mechanical machine and also prone to water damage, rust, and excessive wear.

Because of the breakdowns cited above, non-battery flashlights are generally unreliable as an emergency or long storage time period source of lighting, and particularly in a harsh or moist environment.

Further, the majority of personal lighting products are generally inefficient as being operated using an incandescent (heated filament) light source which is not conserving of energy usage per unit of illumination. Most generator models require considerable hand crank input to effect any significant light output over time.

What is therefore needed is a more compact, more isolated source of emergency lighting which is human powered, but which is also efficient in operation. The device should be impact resistant and have relatively few moving parts and no intense, high force, small area wear surfaces.

Summary of the Invention

The light generating device of the present invention utilizes a large centrally located magnet which is mounted to slide past a magnet pickup or current induction wire which may be preferably mounted at a center point of travel in a tubular housing having a tubular chamber through which the magnet travels. A pair of elastomeric bumpers are located each at the

end of the tubular chamber. Each of the elastomeric bumpers are supported by its own spring secured against the sides, end or both of the terminal ends of the tubular chamber. The mounting sequence is first chamber end or structure to first spring, to first bumper to freely slidable or translatable magnet to second bumper secured by second end or structure of the chamber. The result is a device which both facilitates the manual movement of the flashlight body so that the magnet slides past the center magnet pickup or current induction wire, and also conserves the residual momentum of the magnet once it has traveled past the magnet pickup or current induction wire by providing a bumper and spring to conserve some of the mechanical energy going in the other direction.

Where the size of the magnet is matched to the length of the tubular chamber and the size of the springs, a matched, sealed mechanical system is formed which can be continuously operated with minimal wrist energy. The mechanical input energy is intended to be stored regardless of whether the light is operational during charging or not. The energy consumption of the lamp should be such that the mechanical charging action can keep sufficient energy stored in advance of its consumption in light production so that the flashlight of the invention can be continued to be utilized even when any temporary store of energy provided is depleted. This action is contemplated to be

performed by shaking the flashlight several times to input mechanical and then electrical energy into storage, followed by a period of illumination from an energy reservoir, which may be chemical or capacitor or other.

In addition, an activation switch for external control is had with an external smaller magnet which operates in conjunction with a reed switch to enable mechanical activation without the necessity to form a mechanical linkage between the inside and outside of the flashlight.

One appliance which can greatly expand the capabilities of the flashlight of the invention is a charger which uses inductive energy transfer. Ordinary chargers rely upon physical touching of contacts and the corresponding external corrosion possibilities, as well as the possibility of non-contact with the outside energy source. Because the flashlight of the invention is completely sealed, inductive charging offers secure charging and no possibility of lack of charge through loss of physical contact.

With a charge system, the flashlight is ready to go, ready to be employed in lighting on a moment's notice. A further addition is a paralleling of the on and off switch to be activated by an electromagnet in a charger housing especially in the case of power failure. Since the flashlight unit is self contained, a cessation of charging will not result in drain of

the stored power. Further, a relay which operates to switch the flashlight on will enable its use as an emergency light to enable a user to find it and use it, and to handily pluck it from its charger and exit the building if needed. The flashlight can also be switched on while in the charger, to enable it to act as a continuously charged, fixed location night light, as well as a portable night light.

The charger uses an induction system which has a physical realization matching the coil used in the charging system of the flashlight. Proximity to the charger, and its charging coil or proximity to the electromagnetic field produced by the charger will result in charging. As a result, the structure of the charger is not particularly constrained. A wall plug-in unit which is supported by an outlet and which further supports the flashlight is preferred, but a modular charger which has a wall transformer and a connected sleeve would also work well. The former enables deployment at various outlets in a room, while the latter enables more specialized orientation and deployment.

The flashlight of this invention is further enhanced by the independently utilizable options including (1) addition of a secondary brighter LED and (2) the addition batteries housed in a detachable battery compartment. The batteries serve to power the secondary brighter LED or two LEDs together upon activation of a secondary switch. This is to increase brightness of this

invention. The batteries also serve to act as a one time quick charger for the main capacitor storage unit upon activation of a turbo charge switch. The turbo charge function is used to to reduce the number of shakes required to fully charge the capacitor so that the LED will able to be activated almost instantly, especially when the flashlight is not left on continuous charge. The slide knob disclosed herein can implement the turbo charge function.

Another derivative of turbo charging is trickle charging. The storage capacitor can be set to continuously charge by a pulsed current which will be sufficient to conserve the battery power and overcome capacitor drain, but which can stop by the activation of the slide knob which fully invokes the quick charge.

Brief Description of the Drawings

The invention, its configuration, construction, and operation will be best further described in the following detailed description, taken in conjunction with the accompanying drawings in which:

Figure 1 is a side view of the Faraday flashlight of the present invention;

Figure 2 is a perspective view of the Faraday flashlight as seen in Figure 1 looking toward the front end;

Figure 3 is a front view of the Faraday flashlight seen in Figures 1 and 2;

Figures 4A and 4B are expanded views of a section taken along line 4A and 4B of Figure 2;

Figure 5 illustrates an exploded view of a further embodiment utilizing lateral pinch dampers to protect the casing from magnet force movement;

Figure 6 is a perspective view of a unitary body pinch flexure damper utilized to dampen the impact of a sliding magnet;

Figure 7 is a side view of the damper shown in Figure 6;

Figure 8 illustrates a block diagram of one of the field chargers shown in conjunction with the elements of the flashlight and its magnet;

Figure 9 illustrates a block diagram of another charger shown in conjunction with the elements of the flashlight and an additional induction coil;

Figure 10 illustrates a block diagram of another charger in conjunction with the elements of the flashlight and built-in AC wall plug;

Figure 11 illustrates a front view of a portion of the flashlight housing seen in Figure 10 and illustrating the folding plug blades shown in stored position;

Figure 12 illustrates a block diagram of another instant

quick charger shown in conjunction with the elements of the flashlight and addition of a brighter LED, detachable battery compartment and Turbo Charge Controller;

Figure 13 illustrates a block diagram of another trickle charger shown in conjunction with the elements of the flashlight and addition of a brighter LED, detachable battery compartment and Trickle Charge Controller; and

Figure 14 is a more detailed schematic of the circuitry of both the charger shown in Figure 8 and the flashlight of the invention.

Detailed Description of the Preferred Embodiment

The description and operation of the invention will be best initiated with reference to Figure 1 and which illustrates a Faraday flashlight which will hereinafter be referred to as a flashlight 11. The external appearance of the flashlight 11 discloses two portions, a main housing chamber 13 portion and a front cap 15 portion which is separated from the main housing chamber 13 portion by a dividing line 17. Front cap 15 portion may include a combination or unitary clear cap which includes a threaded engagement portion and integral lens. In the version shown in the figures, a lens will be shown to be separate from the engagement portion of the cap, but this is just one possible variation. At the rear of the main housing chamber 13 is a

protruding lug 19 having an opening 21 which is not immediately visible in Figure 2, but which is indicated by arrow. An upper flattened portion 25 and a lower flattened portion 27 are seen in Figure 2. An expanded portion 29 of the main housing chamber 13 is seen as meeting front cap 15 at the dividing line 17.

At the top of the flashlight 11 an attached switch assembly 31 is seen as having an attached saddle 33 which overlies the cylindrical outer surface and a slide member 35 which has retaining members (not shown in Figure 1) which fit within the saddle 33. The whole of the switch assembly 31 may be mounted to the main housing chamber 13 by gluing, fusion, or the like. Switch assembly includes the slide member 35 to act by virtue of movement of a magnet within slide member 35 to a point over a portion of the housing chamber 13 at which a reed switch (not shown in Figure 1) is located, and in order to close the reed switch by proximity of such magnet. It should be noted that the orientation of the flashlight 11 is such that the internals are protected from water and moisture, including the magnet wire 63 and magnet 65. Magnet 65 typically may have a strength of N35, and the magnet wire 63 may have about 1600 turns. About 1.3 watt can be generated for each passage of the magnet 65 through the coil of magnet wire 63.

However, it is contemplated that the magnet 65 could be made to be external to the main housing chamber 13, while the

magnet wire 63 may be internally or externally located. Further, rather than simple movement of a straight tubular shaped main housing chamber 13, the movement of the magnet 65 could be effected by other mechanical and configurational structure.

As will be seen, the portion of main housing chamber 13 over which the saddle 33 is positioned may provide an accommodation space or depression to better accommodate saddle 33 and especially to protect its becoming dislodged upon external applied force, especially force along the main housing chamber 13.

The front cap 15 is shown as being supplied with a series of indentations 39 which provide not only a decorative effect, but approximate a spacing for finger and hand manipulation. The flashlight 11 is intended to be waterproof, shockproof, and to generally never need servicing as it lacks any sort of bulb which could burn out. It uses a light emitting diode which is shockproof and is not generally expected to be changed. Indentations 39 may also assist machine placement of the front cap 15 consistently to a pre-determined torque in order to provide maximum sealing while minimizing the chance of overrunning the threads of attachment. Also seen is an end surface 41.

Referring to Figure 2, a perspective view of the flashlight

11 as seen in Figure 1, but looking toward the front end, illustrates further details within the cap 15. Just within cap 15, and beyond the end surface 41 is an angled surface 43. Just beyond angled surface 43 is an inner cylindrical surface 45. Adjacent the inner cylindrical surface 45 is a curved lens 47. As will be seen, sealing will occur behind the curved lens 47 and the arrangement of structures is such that any moisture or water which enters the dividing space or dividing line 17 still must negotiate the seal behind the curved lens 47 in order to have an opportunity to further invade the inner workings of flashlight 11. Also seen immediately to the rear of slide member 35 is a slide space 49 which defines the limits over which the slide member 35 may travel. In the configuration of Figure 2 this is seen as allowing a forward and rearward motion along the main housing chamber 13 body, but an arrangement for side to side movement can be made.

Referring to Figure 3, a front view of the Faraday flashlight 11 seen in Figures 1 and 2 illustrates the orientation of structures already covered in detail, as well as the visual effect of a main housing chamber 13 having an expanded portion 29.

Referring to Figures 4A and 4B, expanded views of a sectional view taken along line 4A and 4B of Figure 2 are shown. Beginning at the end of the main housing chamber 13 closest the

protruding lug 19, and adjacent an internal surface 51 of the main housing chamber 13, a centering sleeve 53 is supported by projections 55 and 57. The centering sleeve 53 supports a magnet wire and magnet support assembly 59 which includes a magnet translation support sleeve 61 supporting 1600 turns of magnet wire 63 at a position approximate the center of travel of a magnet 65 which is mounted to freely axially slidably move within the magnet translation support sleeve 61. The term "magnet wire" is utilized only to indicate that this wire is intended to have induced currents due to the movement of a magnet.

The end of magnet translation support sleeve 61 nearest the centering sleeve 53 includes a circumferentially outwardly directed groove 67 to enable it to fit within and be seated against the centering sleeve 53. Near the center of the magnet translation support sleeve 61, a pair of spaced apart lands 69 are provided to both stabilize the magnet translation support sleeve 61 against the internal surface 51 of the main housing chamber 13, and to provide a defined annularly radial volume for the magnet wire 63. In the case shown in Figure 4B, this volume includes a portion of the external surface of magnet translation support sleeve 61 shown with numeral 71 which has a smaller cylindrical radius to accommodate slightly more volume of the magnet wire 63, but this need not be the case in every design.

At a portion of the magnet translation support sleeve 61 opposite the circumferentially outwardly directed groove 67, a radial land 73 is provided for stabilizing the magnet translation support sleeve 61 against the internal surface 51 of the main housing chamber 13.

Within and near the end of the magnet translation support sleeve 61 near the centering sleeve 53 a screw 75 secures a spring retainer 77 to the centering sleeve 53. The spring retainer 77 further secures a rear spring 79, at a first end of rear spring 79, and within the magnet translation support sleeve 61, preferably in a manner that it will not contact or rub against an inner surface 81 of the magnet translation support sleeve 61. A second end of the spring 79 is attached to a first damper 83 by its rearwardly extending boss 85 around a central bore 87.

Within and near the end of the magnet translation support sleeve 61 near the radial land 73 a screw 75 secures a spring retainer 77 to an end wall 89 of the magnet translation support sleeve 61. The spring retainer 77 further secures a front spring 91, at a first end of front spring 91, and within the magnet translation support sleeve 61, also preferably in a manner that it will not contact or rub against an inner surface 81 of the magnet translation support sleeve 61. A second end of the front spring 91 is attached to a second damper 83 by its

rearwardly extending boss 85 around a central bore 87.

As is further shown, the magnet translation support sleeve 61 is not seen to end at the radial land 73, but continues with a web portion 95 leading to a support 97 for supporting a gold capacitor 101 which may preferably be commercially available from Panasonic EECF5R5U105 and may have a value of up to one farad and is limited only by the limitations desired for energy storage capacity. Gold Capacitor 101 provides the energy storage for powering the flashlight 11. Support 97 may continue with a wall 103, as well as a wall which would be present to obstruct the view of Figure 4A, but which is removed in order to see the sectional view of Figure 4A. A divider 105 is seen located over the gold capacitor 101. Above the divider 105 a reed switch bracket 107 supports one or more lengths of tape 109 for spacing a reed switch 111. The reed switch 111 is underneath a position occupied by the forward most translation of slide member 35. A small magnet 115 is shown within the slide member 35 and in a position over and just to the side of the reed switch 111. Small magnet 115 is utilized to cause the reed switch 111 to close when the slide member 35 is in its forward position. Figure 4A also illustrates the depth of an external indentation 117 in the main housing chamber 13 which accommodates the small magnet underneath the slide member 35 which translates within the attached saddle 33. When the slide

member 35 and small magnet 115 are brought rearwardly within the saddle 33 and away from the reed switch 111, the reed switch 111 will open to interrupt any lighting circuit present.

Forward of the support 97, a further support 121 connects the support 97 to a reflector housing 123. At the rear of the reflector housing a light emitting diode 125 may be connected to circuitry 126. Circuitry 126 will provide rectification of the alternating currents produced with the magnet wire 63 and magnet 65 for each travel length of the magnet 65. Light emitting diode 125 is concentrically mounted within the reflector housing 123 and surrounded by a reflector material 127. The inner cylindrical surface of reflector housing 123 may also be reflectorized. Just ahead of the reflector housing 123, the internal surface 51 of the main housing chamber includes a groove 131 which is concentrically larger than internal surface 51. Groove 131 has a radial surface width to fit an "o" ring 135. Groove 131 has an axial depth to accommodate both the "o" ring 135 and about half the thickness of the lens 47. The lens 47 is forced in place by the rearward projection of a butt end 137 *of the inner cylindrical member* 139 *of which the inner* cylindrical surface 45 was previously seen. As also can be seen, a mating space 141 is immediately adjacent the lens 47 and between the main housing chamber 13 and the front cap 15. The mating space 141 leads to a threaded interface including an

outer set of threads 143 on the main housing chamber 13 and an inner set of threads 145 on the front cap 15. The other side of the threaded interface is in communication with the dividing line 17.

Note that any moisture or water must gain admittance in one of two paths. One path is through the dividing line 17, thence through the threaded interface between outer set of threads 143 and inner set of threads 145 on the front cap 15 and to the edge of the lens 47. The other path is between the outer periphery of the front face of the lens 47 and the continuous butt end 137 of the inner cylindrical member 139 of the front cap 15.

In order to enter the inside of the main housing chamber 13, moisture must either go past the sealed barrier between the "o" ring 135 and the groove 131, or between the "o" ring 135 and the periphery of a rear face 147 of the lens 47.

First, it is clear that the flashlight 111 can be provided with varying capacity members. For example, the magnet 65 has been found to work well utilizing a diameter size of about nineteen millimeters and a length of about 28 millimeters. The field strength of the magnet 65 will depend upon the material used. Variations might include the use of two magnets 65 separated by a plastic interconnect. In this configuration, the magnets would excite the magnet wire 63 twice for each tilt of

the main housing chamber 13. Ideally, the pair of magnets 65 could be reverse polarized so that one tilt would be equivalent to two tilts with one magnet. Three or four magnets could be joined together to give four actuations of the magnet wire 63 for each tilt of the flashlight 11.

Conversely, multiple numbers of sections of the magnet wire 63 could be provided. Two sections of magnet wire 63 would produce twice the energy per tilt or travel of the magnet 65 from one end of the magnet translation support sleeve 61 to the other. Again, the strength of the springs 79 and 91, combined with the hardness of the dampers 83 and the weight of the magnet 65 (or magnets 65) will determine the natural frequency of shaking for activation of the flashlight 11. Further, where the magnet translation support sleeve 61 is made from nearly frictionless material and where the magnets 65 are made from a material complementary to the frictionless material of the magnet translation support sleeve 61, very little energy from friction will be consumed and the bulk of the reverse magnetic EMF force will predominate as resistance to shaking the flashlight 11. Insofar as any resistance from air entrapment within the magnet translation support sleeve 61, this can be vitiated by providing alternative routes for air to pass. Alternate routes can be accomplished by providing a core in the magnet 65, or by providing side slots along the side edges of

magnet 65, or by providing long ribs along the inside of the magnet translation support sleeve 61 to provide a reduced surface wear area as well as spacing for displacement air to pass, or the magnet translation support sleeve 61 itself could be provided with ventilation holes to allow air to pass in the space between the an outer surface 149 of magnet translation support sleeve 61 and internal surface 51 of the main housing chamber 13, for example.

Given the fact that the stored energy in the flashlight 11 is accomplished with a high efficiency gold capacitor 101, the storage capability of the gold capacitor can be enlarged by utilizing either more capacitors 101 in parallel, or a larger capacitor 101. Unlike storage batteries, a capacitor 101 will not suffer deleterious effects from being charged for long periods of time. Capacitors may have some leakage or some rating based upon inadvertent leakage, but regardless of this factor, there is no negative effects from keeping a constant charge. As such, the flashlight 11 is ideal for storage in a horizontal position in locations subject to movement. For example, storage under the seat of a truck laterally will result in movement of the magnet 65 from one end of the magnet translation support sleeve 61 each time an alternative corner is turned. In more specialized structures, such as upon surfaces that turn slowly, the mounting of the flashlight 11 will provide

a continuous charge. In machinery which undergoes significant shaking in a predominant direction, the flashlight 11 could also be mounted. The mounting method may vary, but any mounting external magnets should be located away from both the path of travel of the magnet 65. In all of these cases, the flashlight 11 will automatically be available for use in a fully charged condition.

Utilizing the structures described, it is expected that the resulting flashlight 11 could be manually shaken back and forth at approximately one movement per half second, for a total 90 seconds to make enough energy to power the light emitting diode 125 for about 5 minutes. The light output is preferably and deliberately low at about 6000 lux in order that the cycle time enable a user to have the ability "stay ahead" of the energy utilization time. In the example of a ninety second shake for about five minutes of illumination, and depending upon the capacity of the components, it will be preferable to perform the shaking at a time when the light emitting diode 125 is switched off via the switch assembly 31. In emergency circumstances, the user who performs shaking with the light emitting diode 125 on, will experience a lesser cycle time and a jumpy light show. If the components were set to a vigorous ninety second shake followed by five minutes of operation, if the shaking occurred while the flashlight 11 was on, the five minutes would be

reduced to about three and a half minutes.

Referring to Figure 5, an exploded view of a further embodiment of the invention illustrates further internal details as well as the presence of a unitary body pinch flexure damper 151. Also can be seen is a perspective view of an integrated internal support system 155 including the magnet wire and magnet support assembly 59, web portion 95, support 97 forming a semi enclosed circuits area, and attached reflector housing 123.

The integrated internal support system 155 forms a stable support structure which can be securely fixed within the main housing chamber 13 and which will stabilize and support the internals during the shaking operation. Because the system 155 extends essentially the length of the housing 13, its implacement to bear against the rear of the housing 13 at its rear end, and the front of the housing by virtue of the pressure of the cap 15 when engaged on the front of the housing 13.

Further details are seen beginning at the upper left side of the drawing. The saddle 33 is seen to include the slide space 49 through which the slide member 35 can axially translate. Small magnet 115 is seen as fitting under a matching space in the slide member 35. As a result, a matching space 157 need only have a defined separation from the reed switch 111.

The matching space 157 need not be present, as the saddle 33 can be curved to fit on a cylindrical housing, but the use of

matching space 157 enables better control of the assembly process. The centering sleeve 53 is formed as a cover and has a central opening or aperture 159 to accommodate an anchor 161 of the unitary body pinch flexure damper 151. Loading the damper 151 is as easy as threading the anchor 161 through the central opening to anchor it by friction or by adhesive or glue against the sleeve 53. Inasmuch as the whole of the system 155 is under a stabilizing compression, the sleeve 53 and damper 151 will not tend to dislodge itself from its connection with the sleeve 53.

An aperture 162 in the end wall 89 will accommodate the other anchor 161 of the other pinch flexure damper 151. Once the anchor 161 is threaded through the aperture 159 or 162 in either the sleeve 53 or the end wall 89, the anchor 161 may be trimmed or clipped as is necessary to provide any clearance for objects with which the anchor 161 would otherwise interfere. Also seen are screws 163 which are used to hold the reed switch bracket 107 against a set of bare wires 165 which extend upward from the circuit board divider 105. Another screw 167 is used to secure the gold capacitor 101 to the circuit board divider 105. All of the electronics fit within a box opening including the pair of oppositely spaced walls 103 and underlying support 97.

Referring to Figures 6 and 7, a perspective and a side view of the unitary body pinch flexure damper 151 illustrates further

details thereof. The anchor 161 may include a land 169 having a conic surface 171 and spaced apart from a base surface 173 of the damper 151. A portion of the anchor 175 exists between the land 169 and the base surface 173 which will enable capture of the structures around the apertures 159 and 162 to help stabilize the damper 151. The extent of the anchor 161 beyond the land 169 can be trimmed after installation if there is an interference problem. The main extent of the anchor 161 is to facilitate manual threading through apertures 159 and 162, and tension to pull the land 169 through.

Base surface 173 is part of a base 177. A pair of hourglass shaped or angled side walls 181 and 183 extend from the base 177. Each of the side walls curves gently toward each other for about half of their length and then back to form a top internal curve 185. The curve 185 sits below a rounded solid end member 189.

The shaped, opposing nature of the side walls 181 and 183 insure that any axial compressive force borne between the solid end member 189 and the base 177 will result in the side walls 181 and 183 bending toward each other at their mid points. The first stage of deformation will occur as the side walls 181 and 183 bend about their mid sections with the mid sections of the side walls 181 and 183 being driven toward each other. The second stage of deformation will occur once the mid sections of

side walls 181 and 183 have made contact, with the second stage of deformation resulting in the increase in surface area contact of the mid sections of the side walls 181 and 183 with each other.

The first stage of deformation slows the movement of the magnet 65 less rapidly than the second stage of deformation. Because of the dampening action, no spring return force action is had with respect to the magnet 65. This effect is due to the mass of the magnet which is about even with the mass of the remainder of the flashlight 11. The mass amounts are such that a typical user's movements significantly move the flashlight back and forth and the path of travel of the magnet 65 is significantly shortened by movement of the flashlight 11 depending upon the severity and frequency with which it is shaken. The main action of the dampers 151 is to prevent the magnet 65 from making hard impact against the structure of the magnet wire and magnet support assembly 59, especially where the flashlight 11 is shaken severely. Damping may also be aided by the clearance between the magnet 65 and the inner surface 81 of the magnet translation support sleeve 61.

The advantages of the flashlight 11 are clear in that a user can have a flashlight available for emergency use or backup use and which does not need batteries. The sealed unit of the flashlight 11 can be left idle for decades and then pressed into

use. Because a capacitor 101 is used for energy storage and because capacitors, especially high efficiency (charge per unit weight) capacitors will typically drain its charge. As a result, a user who typically stores the flashlight 11 in a secure location must find and shake the flashlight 11 to energize it before it is ready to use.

Further disclosed herein are ways of charging capacitor 101 which better enable the flashlight 11 to be used as an emergency light. Many emergency lights left in charging position for long periods of time fail because the storage cell typically used in such flashlights has either corroded, or failed because of being required to hold a charge for a long period of time. Where the charger is co-located with a conventional flashlight, the heat from the charger can damage the battery.

The flashlight 11 is amenable for use with a charging coil which can charge the capacitor 101 through electromagnetic force energy received through the flashlight 11 main housing chamber 13. The charger can be constructed in a variety of configurations to enable a high variety of support structures. In addition to an overlying sleeve, any housing which contains a coil or can transmit a magnetic field which can induce current in the magnet wire 63 will act to keep the capacitor 101 charged. This will enable a user to keep the flashlight 11 as a quick ready emergency flashlight which is instantly available

from its charger. With an emergency which is associated with power failure, the flashlight 11 is ready to go and need only be shaken to supplement current which is used since retrieval from the charger.

Referring to Figure 8, a block diagram illustrating the charger and its relationship with the overall flashlight 11 circuitry is shown. A POWER SOURCE INPUT line input block 201 is seen supplying power to CHARGER ELECTRONICS block 203. The POWER SOURCE INPUT line input block 201 can be either an AC line input or a DC input having inverter electronics which will produce an alternating magnetic field. The charger electronics block 203 is connected to a charging coil 205. The flashlight 11 is shown physically within the charging coil 205 to illustrate one manner with which an electromagnetic field can be induced into the magnet wire 63 within the flashlight 11. The remaining portion of Figure 8, beginning with magnet wire 63, illustrates components associated with flashlight 11.

The charging coil 205 is separated from but in close proximity to a coil of magnet wire 63. Magnet 65 is shown in a position to move through the magnet wire 63. Thus the magnet wire 63 is energized either by movement of magnet 65 or by an alternating electromagnetic field from the charging coil 205.

Magnet wire 63 is connected to a RECTIFIER block 211. RECTIFIER block 211 is connected to an AVERAGE VOLTAGE

PROTECTION or AVERAGE VOLTAGE PROTECTION block 213. The AVERAGE VOLTAGE PROTECTION block 213 is connected to a CHARGE STORAGE CAPACITOR block 215 and keeps the voltage to an average. One of a pair of leads from the CHARGE STORAGE CAPACITOR block 215 is connected in series through a REED SWITCH block 219. The other lead from the a CHARGE STORAGE CAPACITOR block 215 and a lead from the REED SWITCH block 219 is connected to a WHITE (light) LED block 221.

WHITE LED block 221 is connected in parallel to an ELECTROSTATIC CHARGE PROTECTOR block 223. A SLIDE KNOB block 225 is shown adjacent to but separated from the REED SWITCH BLOCK 219. When the SLIDE KNOB block 225, containing small magnet 115 is moved into proximity to the REED SWITCH BLOCK 219, reed switch 111 closes to turn the flashlight 11 on. When the SLIDE KNOB block 225, containing small magnet 115 is moved out of proximity to the REED SWITCH BLOCK 219, reed switch 111 opens to turn the flashlight 11 off.

Referring to Figure 9, a schematic illustrating the use of the flashlight 11, shown as a rectangle supported by a charger shown by demarcation of its charger housing 251 illustrates some support for the flashlight 11 housing chamber portion 13 or at least some orientational registering of a charger housing 251 with respect to the flashlight 11 charger housing 251. Within the charger housing 251, a switch electro magnet block 255 is

oriented to a position close to either (1) an auxiliary reed switch 256 which is connected in parallel with the reed switch 111, or (2) directly to the reed switch 111. Either the reed switch 111 or 256, upon energization of the switch electro magnet block 255 to which the RELAY block 257 is connected, will cause the flashlight 11 to turn on.

Since the switch assembly 31 is located over the reed switch 111, a triggering switch electro magnet block 255 would either cover or obstruct operation of the reed switch 111 and in some cases be affected by the small magnet 115. By making a separate reed switch 256 wired in parallel with reed switch 111 and locating it elsewhere, a user has independent "on" control. A user can switch the flashlight 11 to the "on" position whether or not a power failure has occurred.

In one case, RELAY block 257 is energized by a CHARGER ELECTRONICS block 261. The CHARGER ELECTRONICS BLOCK 261 is connected to a POWER SOURCE INPUT block 263. Where the POWER SOURCE INPUT block 263 includes both line electrical input and a battery storage, it can switch to battery automatically upon power failure. An optional charger LED 265 can be used to not only indicate the energization of the charger of the charger housing 251 but also to provide some illumination upon power failure where the POWER SOURCE INPUT block 263 includes battery power.

When the power input to the charger circuit of charger housing 251 fails, the POWER SOURCE INPUT block 263 switches to battery power and either energizes or maintains energization of the charging coil 205. The POWER SOURCE INPUT block 263 then closes or opens the RELAY block 257 to energize or de-energize switch electro magnet block 255. For maximum power savings, the steps will include opening a reed switch 111 or 256 with de-energization of switch electro magnet block 255 to enable the reed switch 111 to close by the cessation of a electromagnet in opposition to a permanent magnet, for example.

In any event, the actuation of RELAY block 257 acts to close the reed switch 111 to turn the flashlight 11 on. Preferably the charger within the charger housing 251 will be in a position to lend support to the flashlight 11 and preferably to orient flashlight 11 in a vertically upward orientation. This results in the combination charger in charger housing 251 and flashlight 111 becoming a power failure light. A home or office equipped with a number of such charger housing 251 and flashlight 11 combination sets would experience automatic night lighting upon power failure. However, night lights cannot be removed and taken along. In situations where one or two occupants in a dwelling experience a power failure, they can not only have enough light to see, but can go directly to the flashlight 11 and remove it from the charger housing 251 and use

the flashlight 11 to assist in evacuation of the building.

In a business with a number of employees, and equipped with a large number of charger housing 251 and flashlight 11 combination sets, employees would each have a handy light to assist in evacuation. In both the home and business situations, a long evacuation route could be managed because of the ability to manually add power to the flashlight 11 by shaking. By having a charger housing 251 to provide constant charging, each of the flashlights 11 would be completely charged and ready to go in the event of a power failure.

Again, the charger housing 251 can be of any shape which will communicate power to flashlight 11 and of any orientation which will enable actuation of the reed switch 11 upon loss of power. In the alternative, the relay 257 and electrically actuated switch electro magnet block 255 need not be present for two other alternatives. In a first alternative, the flashlight 11 is maintained in the off position, but under constant charge. In this situation, the user must, upon power failure, find the charger housing 251 and flashlight 11 combination set in the dark. This is not the optimum situation, but is manageable where the charger housing 251 and flashlight 11 combination set is kept in an easily reachable location or where the charger carries its own illumination LED in place of charger LED 265.

A second alternative involves the flashlight 11 being left

on permanently. As stated earlier the amount of light from the flashlight 11 is not high where a single white light emitting diode is used. Where the flashlight 11 is to be left on constantly, it will not output a significant amount of light in the daytime to be noticed. At night, the light output will be comparable to a night light. If left on constantly, the flashlight 11 should have a power input sufficient to keep the capacitor fully charged and to equal the amount of light output from the white light LED source 221.

Of course, in the most automated configuration, whenever the flashlight 11 is placed into a pre-determined resting position within the charger housing 251, the charging coil 205 charges the magnet wire 63. The charging coil 205 on the charger may preferably be in vertical position, in close proximity to the charging coil 205 when the flashlight 11 sits in vertical position to the charger housing 251.

Referring to Figure 10, many of the features which are possible in Figures 8 and 9 have been combined into a single housing. A retractable AC power plug 275 is located at the lower end of the flashlight 11 housing housing 251. The plug 275 is sufficient to support the flashlight 11 from a common alternating current outlet. Because the power is made available directly to the flashlight 11 charger housing 251, the charging coil 205 to magnet wire 65 connection is not necessary.

The power source 263 can be a capacitative power transfer device with a power pickup in the charger electronics block 261. Such an arrangement enables the inside of the charger housing 251 to continue its sealed relationship to the components seen in Figure 5. Capacitive transfer can be had with a separate line within the main housing chamber 13 connecting directly to the charger electronics 261, or by direct conduction using connector terminals which formed at the time the charger housing 251 is formed. The seal of the main housing chamber 13 can be maintained by a variety of mechanical means combined with different structure to take power from the power plug 275 to the rectifier.

The other components seen in Figure 10 are the same as seen in the Figure 9. In the configuration shown, the flashlight 11 can be manipulated to deploy the blades of the plug 275 to a position for insertion in a wall plug. The modes of operation including (1) detection of loss of input power to then cause illumination of the LED 125, or (2) constantly on as selectable by the user by manipulation of the reed switch 219 and preferably with enough power input capability to keep a full charge under conditions of constant illumination, or (3) constantly off and charging as selectable by the user and preferably assisted with a charging illumination charger LED 265 to assist location of an off flashlight 11 in the dark and (4)

flash the illumination of the charger LED 265 in the event of an AC power failure.

Referring to Figure 11, a front view of the charger housing 251 is shown with the AC power plug 275 seen as a pair of blades folded to a position flush with the housing 25. In this manner, the AC power plug 275 can be deployed for charging and support from a wall outlet, and folded to a stowed position when carried or stored not in charging position.

Referring to Figure 12, a schematic shows one manner for implementing two optional features. A detachable battery compartment 281 is preferably external to the flashlight and preferably has two terminals 283 that mate to the corresponding input terminals 285 on the flashlight which lead to a quick charge controller 291. The functions of the quick charge controller 291 are two fold. The quick charge controller 291 drives a brighter LED, seen as white LED light source 293, upon activation of the reed switch RS1. Reed switch RS1 is connected between the quick charge controller 291 and one terminal of the second white LED light source 293. Reed switch RS1 operates with slide knob 295.

A switch RS2 is connected between the quick charge controller 291 and one terminal of the charge storage capacitor 215. The quick charge controller 291 is thus enabled to quick charge the charge storage capacitor 215 once upon activation of

reed switch RS2. Charge storage capacitor 215 is charged by the quick charge controller 291 by for a fixed period of time. Where the external charger is not used or available, this "quick charge" feature enables a user to quickly grab the flashlight and get instant light, followed by the long term ability to provide light by manual charging or shaking. Again, slide knob 295 is shown to be in operational proximity to the RS1 switch, while a slide knob 297 is shown to be in operational proximity to the RS2 switch.

The slide knob switches 225, 295 and 297 may be separately operated, or jointly operated, or sequentially operated. For example, where a single actuation is had, the quick charge controller may momentarily check the charge storage capacitor to see if it is charged, and then charge it if it is not charged, and then make a decision on the second white LED light source 263 based upon the level of charge of the charge storage capacitor, and the voltage magnitude supplied by the detachable battery compartment 281.

If the charge storage capacitor 215 is charged, such as from an external charger, connection to switch RS2 would not be had, but the connection to switch RS1 would be enabled. Of course, the quick charge controller 291 would be internally set so that the absense of any voltage from the detachable battery compartment would not result in bleedoff from the charge storage

capacitor back through the RS2 switch, nor any activation of the second white led light source 293 should only a manual source of charge be available.

Referring to Figure 13, the detachable battery compartment is external to the flashlight and has two terminals that mate to the corresponding terminals on the flashlight. A trickle charge controller 299 replaces the quick charge controller 291 and is connected to the detachable battery compartment 281. The functions of A Trickle Charge Controller is two fold, it drives the second white LED light source upon activation of the reed switch RS1, and it quick charges the charge storage capacitor 215 once upon detection of activation of reed switch RS1. Capacitor 215 is periodically charged by the trickle charge controller 299 for a short duration of time until the charge storage capacitor is fully charged and the flashlight is ready for use most of the time.

Referring to Figure 14 a more detailed schematic is shown. This schematic will illustrate alternating current conversion to a lower frequency field which matches, as much as possible, the natural frequency of the magnet wire 63. The circuitry shown which is downstream of the first rectifier section could be used in conjunction with a direct current power source.

Beginning at the left, a charger circuit 301 includes a plug 303 will take an alternating current input (such as 220 or

110 volt) from a wall socket as is typically found in the home. A switch SW1, connected to the line terminal of plug 303, enables the charger circuit 301 to be turned off without removing the plug 303 from its wall connection. A filter set consisting of a parallel combination of a resistor R1 and a capacitor C1 supplies the filtered AC current to position 1 of diode rectification bridge B1. Position 3 of diode rectification bridge B1 is connected to the other or neutral terminal of the plug 303. Position 4 of the of diode rectification bridge B1 is grounded and position 2 of the of diode rectification bridge B1 forms a main node for the remainder of the connected circuitry of the charger 301.

Position 2 of diode rectification bridge B1 is connected to ground through a capacitor C2 and position 2 of diode rectification bridge B1 is also connected to ground through a series combination of resistor R2 and a light emitting diode ON LED.

Position 2 of diode rectification bridge B1 is connected through a resistor R3 to the collector of a transistor Q1, the emitter of transistor Q1 being grounded. The collector of transistor Q1 is connected through a capacitor C3 to the base of a transistor Q2. Further, position 2 of diode rectification bridge B1, is connected through a resistor R4 to the collector of transistor Q2.

Position 2 of diode rectification bridge B1 is connected through a resistor R6 to the collector of transistor Q2 the emitter of transistor Q2 being grounded. The collector of transistor Q2 is connected through a capacitor C4 to the base of transistor Q1. Further, position 2 of diode rectification bridge B1, is connected through a resistor R5 to the collector of transistor Q2.

The collector of transistor Q2 is connected through a resistor R8 to the base of a transistor Q3, the collector of transistor Q2 the emitter of transistor Q2 being grounded. Further, position 2 of diode rectification bridge B1 is connected through a series combination of a resistor R7 and a coil L1 to the collector of transistor Q3. The coil L1 should have a size and matching characteristic with the coil of magnet wire 63 of the flashlight 11 to obtain maximum power transfer characteristic.

Also seen, and shown somewhat schematically for orientation purposes, is the coil of magnet wire 63 and the charging magnet 65 which passes through it. The coil L1 and coil of magnet wire 63 are enabled to be placed into a physical proximity such that energization of coil L1 will energize the coil of magnet wire 63. Structures which may accomplish this include providing a larger coil L1 into which the flashlight 11 housing 13 may fit, or some such other compatible structure.

Continuing with the circuitry for the flashlight 11, the coil of magnet wire 63 is connected to positions 2 and 4 of a diode rectification bridge B2. Positions 1 and 3 of diode rectification bridge B2 are connected through a parallel combination of a 5.1 volt zener diode Z1, and a capacitor C5 which is shown as capacitor 101 in the other views. Positions 1 and 3 of diode rectification bridge B2 are connected through a series combination of reed switch 111 and illumination LED 125, both of which were seen in the previous drawings.

Table 1

Circuit Values

R1	1Mega ohm
R2	3k ohms
R3,R6	2.7k ohms
R4,R5	47k ohms
R7	12k ohms
R8	2k ohms
C1	0.22pF
C2	22μF
C3,C4	392 μF
C5	1F, 5.5 volt
Q1,Q2	9014C
B1	1N4001
B2	1N4004
Illum.LED	NSPW500BS

While the present invention has been described in terms of a flash light not needing incandescent bulbs or batteries, its charging system to permit quick emergency light use, and more particularly to particular structures which are both sealed and manually powered lighting device, the principles contained

therein are applicable to other instruments, devices, processes and structures in which sealed, water proof, and underwater lighting can be provided.

Although the invention has been derived with reference to particular illustrative embodiments thereof, many changes and modifications of the invention may become apparent to those skilled in the art without departing from the spirit and scope of the invention. Therefore, included within the patent warranted hereon are all such changes and modifications as may reasonably and properly be included within the scope of this contribution to the art.